

1/100

FIG. 2

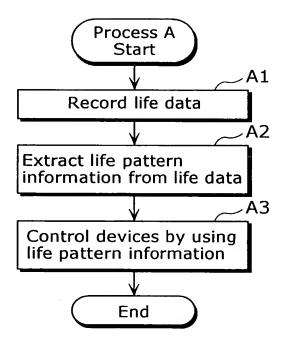


FIG. 3

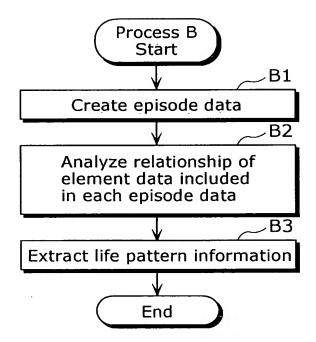


FIG. 4

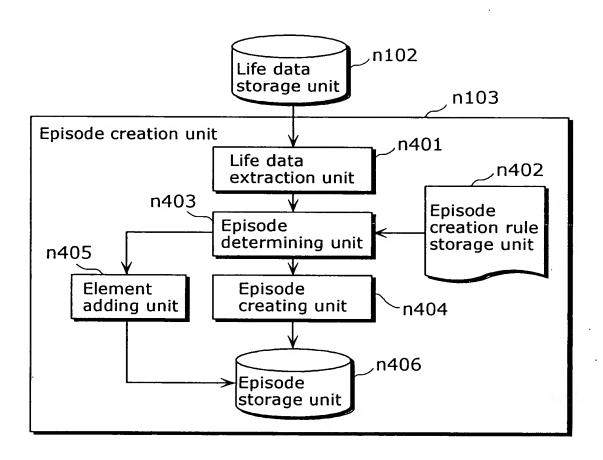
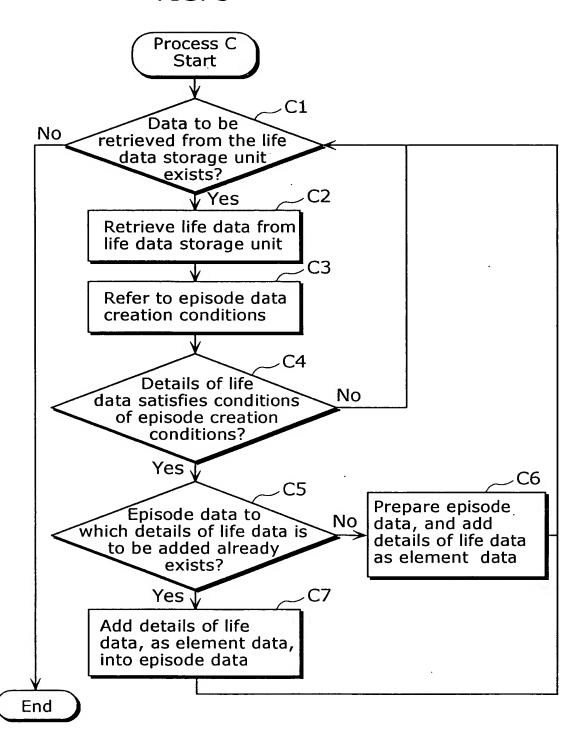


FIG. 5

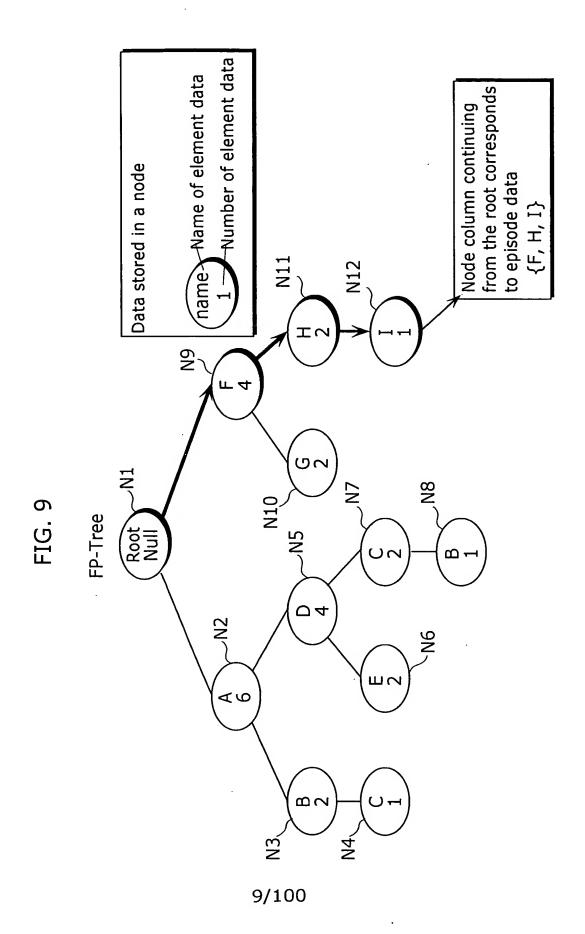


1. Add name of device

Life data

Data 701	Data 702	Data 703	Data 704	Data 70F	207 ster	Data 707		Data 708	Data 700	Data 710	Data 711	Data 717	77 / 2007	
:														
Details of operation	Timer ON	Timer ON	Timer ON	Power ON	Power ON	Power OFF	Power OFF	•••	Timer ON	Timer ON	Timer ON	Timer ON	Power OFF	
Device type	Light	Air conditioner	Rice cooker	Cooking range	Television	Air conditioner	Light	•••	Alarm clock	Air conditioner	Rice cooker	Television	Television	
Date and time of operation	2002/08/30 06:10	2002/08/30 06:11	2002/08/30 06:15	2002/08/30 07:00	2002/08/30 07:01	2002/08/30 08:30	2002/08/30 08:31 Light	•••	2002/08/31 06:45	2002/08/31 06:45	2002/08/31 07:00	2002/08/31 07:05 Television	2002/08/31 08:00	•••

Episode data	data
Episode	Episode name {element data 1, element data 2,, element data n}
08/8	(light air conditioner rice cooker)
0/30	(Alarm clock air conditioner rice cooker television)
10/0	And in clock, an conditional, nee cooker, relevision?
9/1	{Light, alarm clock, air conditioner, rice cooker, radio}
9/5	{Light, air conditioner, rice cooker, radio}
9/3	{Alarm clock, air conditioner, rice cooker, television}
9/4	{Alarm clock, air conditioner, rice cooker, radio}



n406 Episode storage unit n104 Episode analysis unit n901 Episode input unit n902 Frequency Frequency derivation unit storage unit n904 Sorting unit n903 n905 Element retrieval unit n906 Element name determining unit n909 n907 Element number FP-Tree Node creation unit changing unit storage unit n908

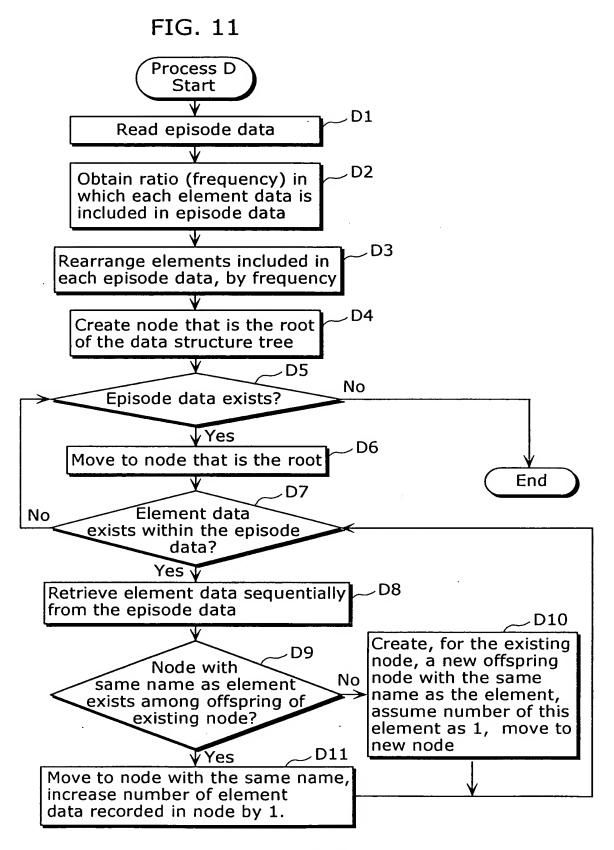


FIG. 12

Element name	Light	Air conditioner	Rice cooker	Alarm clock	Television	Radio
Frequency	0.5	1.0	1.0	0.5	0.33	0.33

Episode data 8/30 {Light, air conditioner, rice cooker} 8/31 {Alarm clock, air conditioner, rice cooker, television} 9/1 {Light, alarm clock, air conditioner, rice cooker, radio} 9/2 {Light, air conditioner, rice cooker, radio} 9/3 {Alarm clock, air conditioner, rice cooker, television} 9/4 {Alarm clock, air conditioner, rice cooker, radio}



8/30 {Air conditioner, rice cooker, light} 8/31 {Air conditioner, rice cooker, alarm clock, television} 9/1 {Air conditioner, rice cooker, alarm clock, light, radio} 9/2 {Air conditioner, rice cooker, light, radio}

{Air conditioner, rice cooker, alarm clock, television} 9/4 {Air conditioner, rice cooker, alarm clock, radio}

Episode data

9/3

FP-Tree N1 Root Air conditioner 6 N2 N3 Rice cooker 6 N4 N5 Light 2 Alarm clock 4 N10 **N7** Television 2 Radio 1 Light 1 Radio 1 ~N8 -N6 Radio 1 – N9

FIG. 15

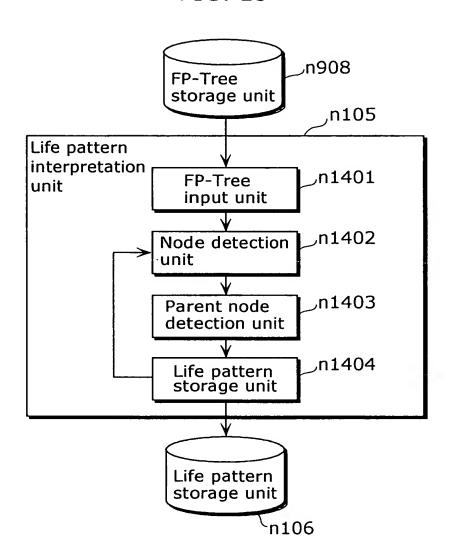
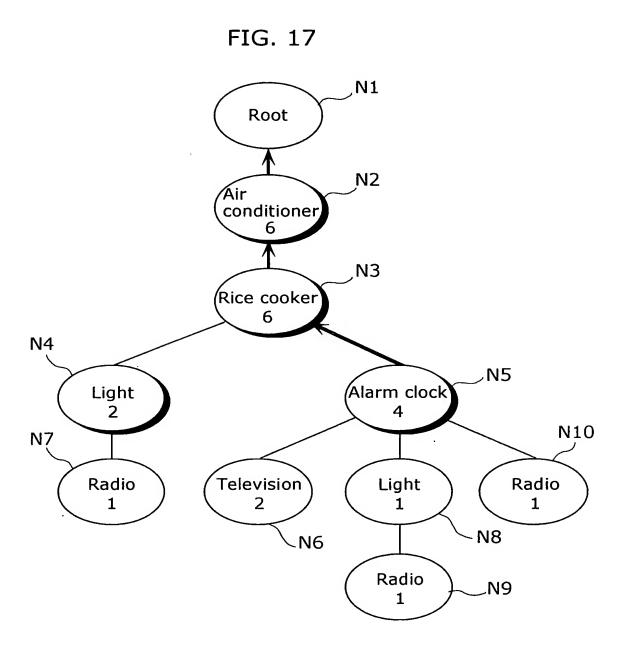


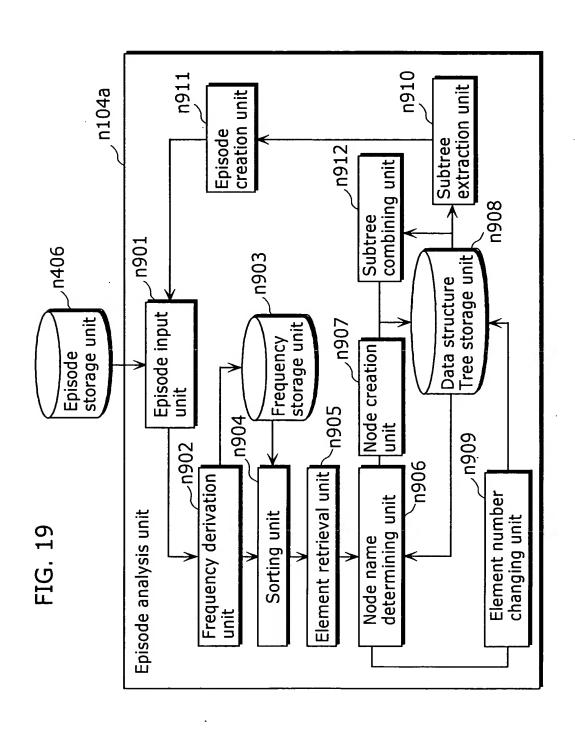
FIG. 16 Process E Start -E1 Read FP-Tree data Look in FP-Tree for node E2 with the predetermined node name **E3** Undetected node No with predetermined node **E7** name exists? Record device that is in √ Yes a strong co-occurrence -E4 relationship with the No predetermined node Parent node exists? into the life pattern information storage unit E5 √Yes Track parent of the node End E6 Record node name of parent as a device in a strong co-occurrence relationship with the predetermined node



Life pattern information

Devices used together with the alarm clock in the morning (6:00 to 9:00)

{Air conditioner, rice cooker}



Process F Start ۶₁ Process D -F2 Read FP-tree data -F3 One or more No nodes exist immediately under FP-Tree root? Yes Separate into subtrees having the nodes immediately under ∠F4 FP-Tree root as roots _F5 Create episodes from each subtree -F6 Process F ∠F7 Return re-constructed subtrees to original FP-Tree End

FIG. 21 N2 Root ,NЗ Rice cooker N4 N5 Alarm clock Light 2 N10 Ņ7 Radio 1 Television 2 Light 1 Radio 1 -N8 - N6 Radio _ N9

```
Episode data
8/30 {Rice cooker, light}
8/31 {Rice cooker, alarm clock, television}
9/1 {Rice cooker, alarm clock, light, radio}
9/2 {Rice cooker, light, radio}
9/3 {Rice cooker, alarm clock, television}
9/4 {Rice cooker, alarm clock, radio}
```

FIG. 23B FIG. 23A N5 Root N4 N10 Root Radio Television 2 Light 1 Ν7 1 -N8 N6 Radio 1 Radio 1 -N9

FIG. 24A

FIG. 24B

Episode data

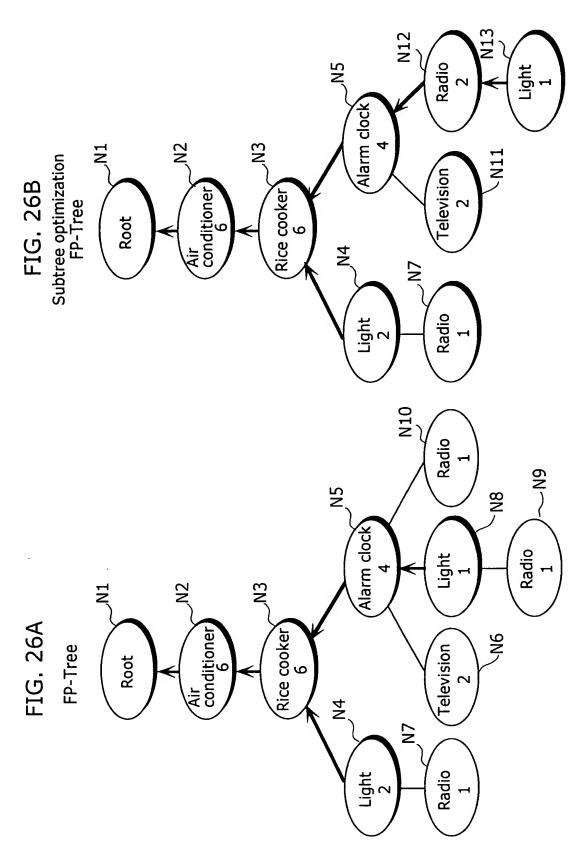
8/ 30 {} 9/ 2 {Radio}

Episode data

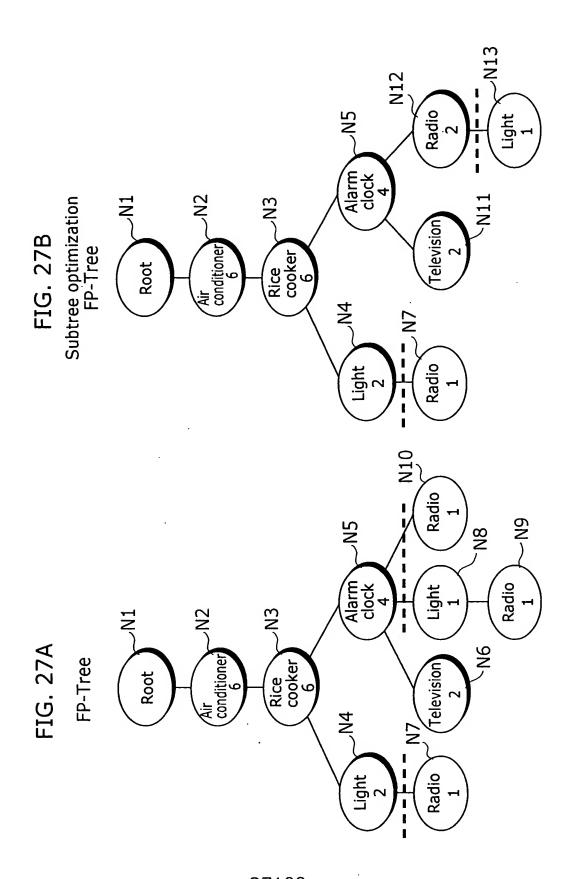
8/31 {Television}
9/1 {Light, radio}
9/3 {Television}
9/4 {Radio}

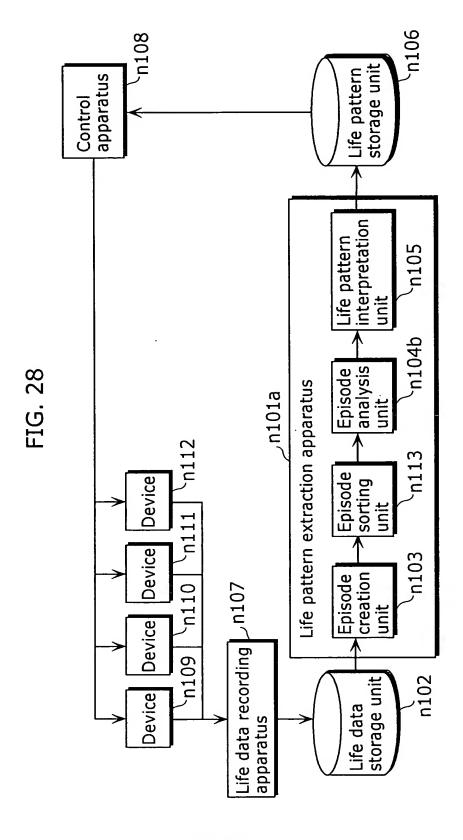
Subtree optimization FP-Tree N1 Root Air conditioner N2 .N3 Rice cooker 6 N4 Light 2 Alarm clock 4 N12 N7 Television Radio Radio 2 2 2 N13 N11 Light 1

25/100



26/100





28/100

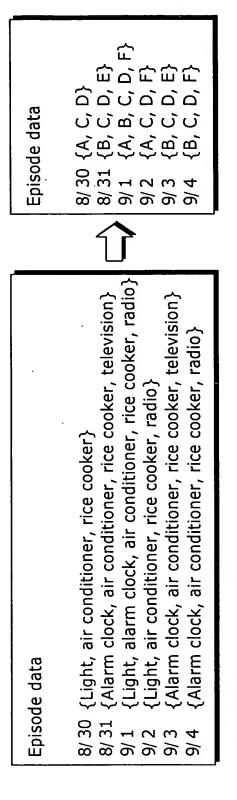
FIG. 29 n406 **Episode** storage unit n113 Episode sorting unit n2801 Episode input unit n2802 Input episode storage unit n2803 Input episode determining unit n2804 Most-frequent element identification unit n2805 Most-frequent n2806 element extraction unit n2807 Input episode classification Output episode storage unit unit

Process G Start G1 Read episode from episode storage unit -G2 No Input episode exists? Yes G3 Obtain element with highest frequency from each input episode -G4 Transfer element with highest frequency from each input episode to output episode storage unit **G**5 Group input episodes according to the types of the elements removed from each input episode -G6 Repeat process for each of the grouped

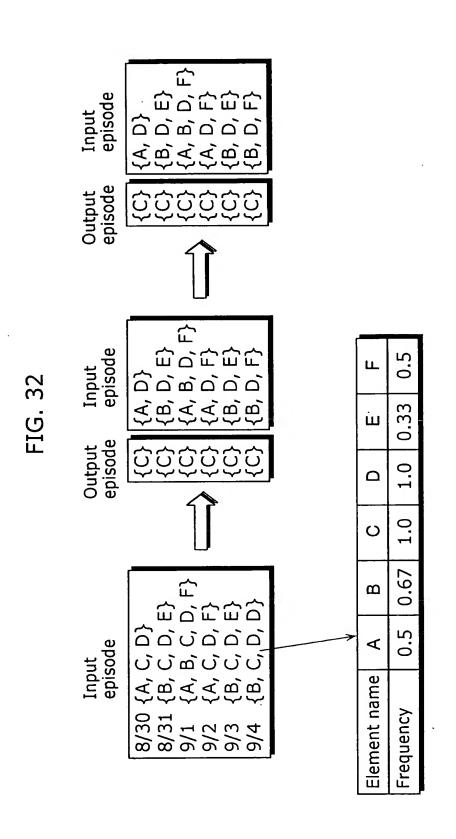
End

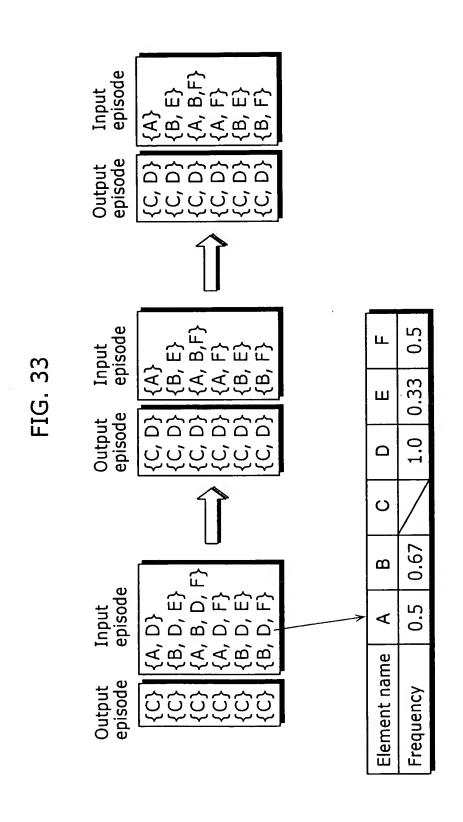
input episodes

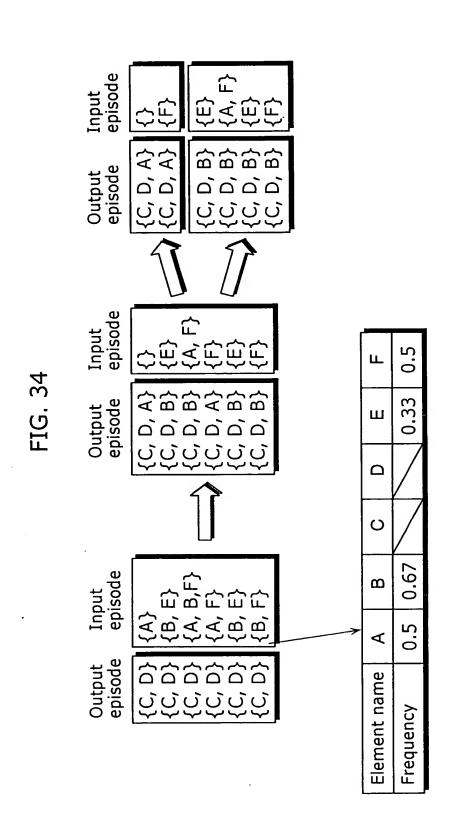
FIG. 3.

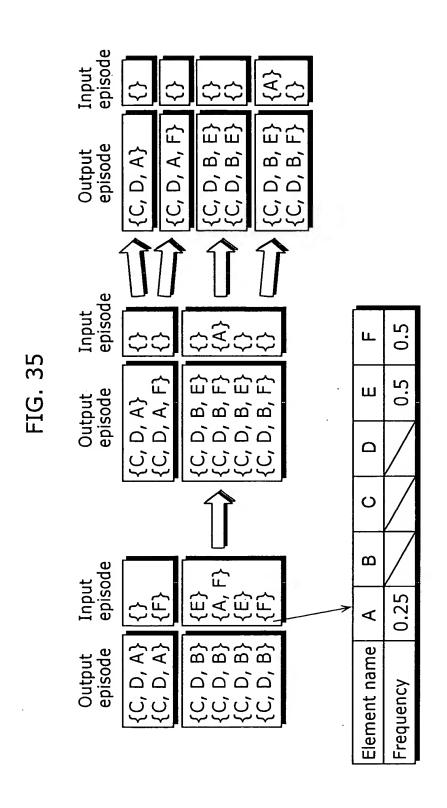


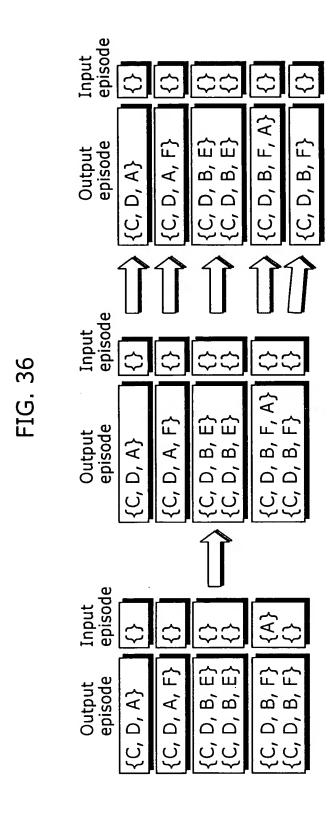
E: Television, F: Radio B: Alarm clock, C: Air conditioner, D: Rice cooker, A: Light,



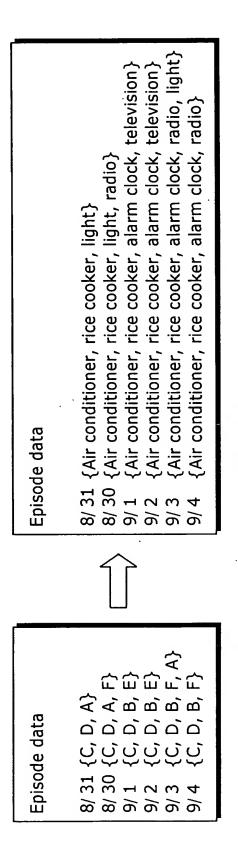






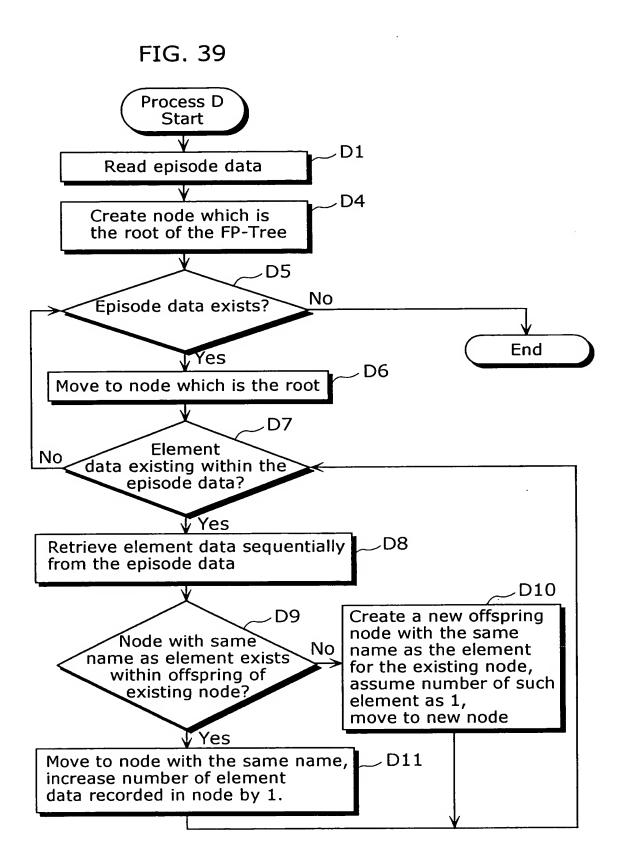


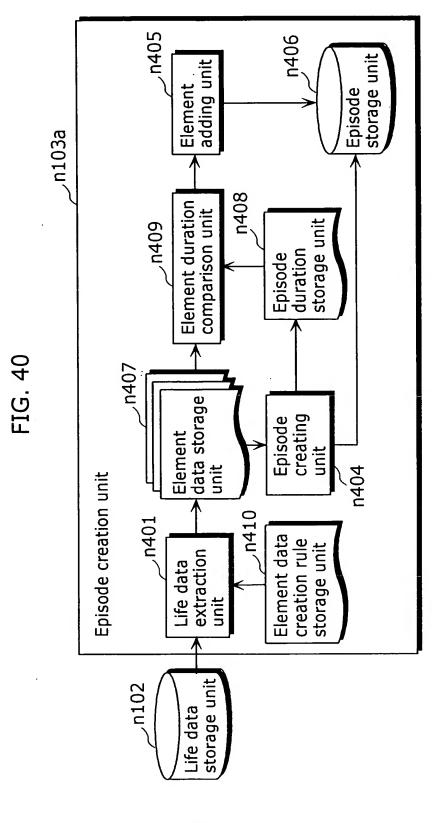
36/100



Radio E: Television, F: Rice cooker, <u>:</u> C: Air conditioner, Alarm clock, .. B: A: Light,

FIG. 38 n2806 Output episode storage unit n104b Episode analysis unit n901 Episode input unit n905 Element retrieval unit n906 Element name determining unit n909 n907 Element number FP-Tree Node creation unit changing unit storage unit n908





40/100

FIG. 41 Process H Start **H5** .H1 Data to be Episode data Yes No retrieved from life created for all element data storage unit data? exists? ▼Yes √No ∠H6 ∠H2 Retrieve 1 unit of life data Retrieve element data from from life data storage unit. element data storage unit. Refer to element data Create new element data creation conditions **H7** End Record duration of episode .H3 data into episode duration Conditions No storage unit of element data creation conditions satisfied? **H8** Element for Yes ∠H4 No comparison exists in element data Record details of element storage unit? data in element data storage unit **H9** Yes Retrieve 1 unit of element data from element data storage unit. Refer to duration of element data. H10 Duration of No element data satisfies predetermined condition? H11 Yes Add element data to episode data.

41/100

Element data creation rules

The group of the following details regarding device use by a user is assumed as element data:

- · Device name
- · Usage start time
- · Usage end time

FIG. 43

	Data 4101 Data 4102 Data 4103 Data 4105 Data 4106															
	•••															
	Details of operation	Power ON	Power ON	Power ON	Power OFF	Power OFF	Power OFF	Power OFF		•••	Channel 2	Power ON	Volume UP	Channel 8	Power OFF	•••
	Device type	Television	Air conditioner	Cooking range	Cooking range	Air conditioner	Television	Light		•••	Television	PC	Television	Television	Television	•••
Life data	Date and time of operation	2002/08/30 06:11	2002/08/30 06:15	2002/08/30 07:00	2002/08/30 07:03	2002/08/30 08:30	2002/08/30 08:31	2002/08/30 08:45		•••	2002/08/31 06:45	2002/08/31 06:45	2002/08/31 07:00	2002/08/31 07:05	2002/08/31 08:00	•••

FIG. 44

Element data

Element ID	Device name	Start time	End time	
1	Television	6:11	8:31	
2	Air conditioner	6:15	8:30	
3	Cooking range	7:00	7:03	
	Light		6:45	
•	•	•	•	
•	•	•	•	
•	•	•	•	
	PC	6:45		

FIG. 45

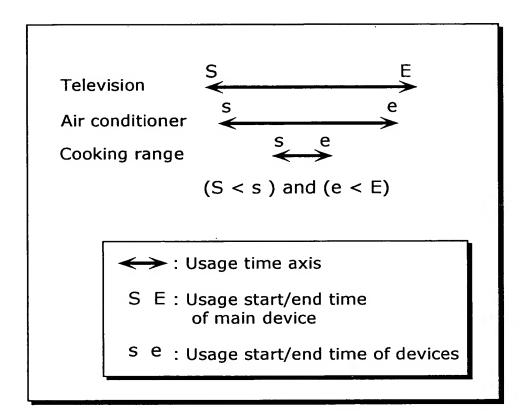


FIG. 46

Episode data regarding use of television

{television, air conditioner, cooking range}

Episode data regarding use of air conditioner

{air conditioner, cooking range}

Element data creation rules

The group of the following details regarding content or device use by a user is assumed as element data:

- · Content or device name
- · Usage start time
- · Usage end time

E. e : Application termination time S, s: Application activation time Usage time axis of each application (S < S < E) or (S < e < E)Air conditioner Television Radio

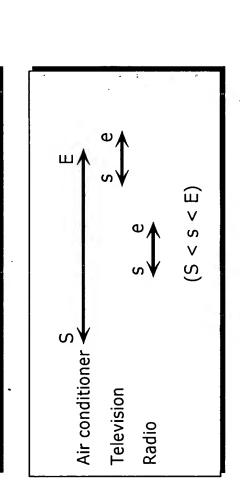


FIG. 48

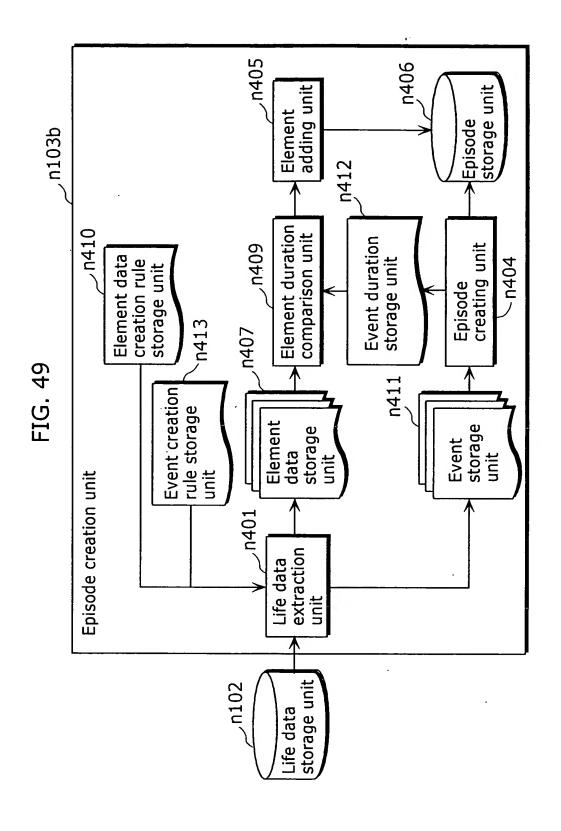
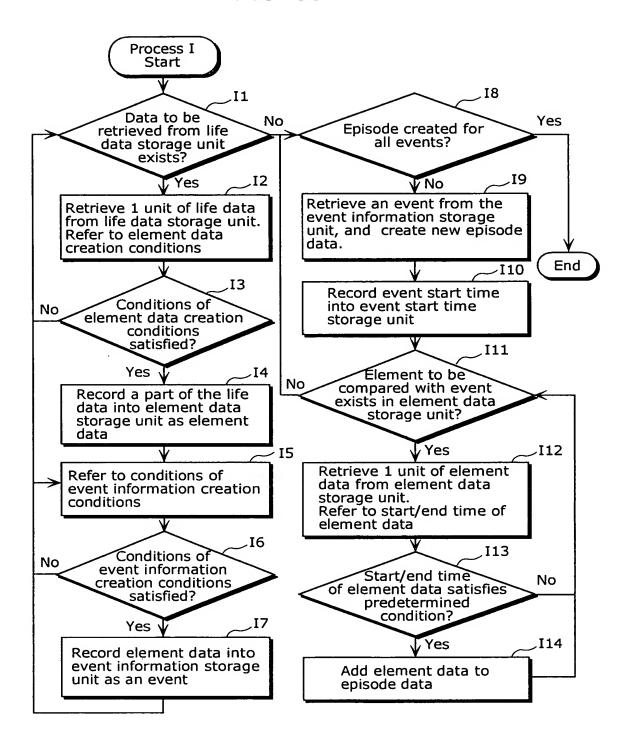


FIG. 50



Event creation rules

- ■Details of Event

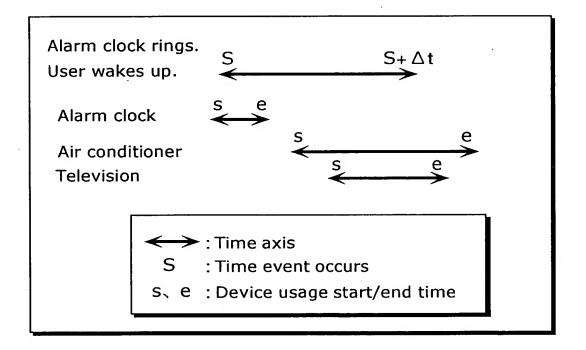
 Turning-ON the power of a random device
- ■Duration of event
 5 minutes, starting from turning-ON of power

FIG. 52

Event data

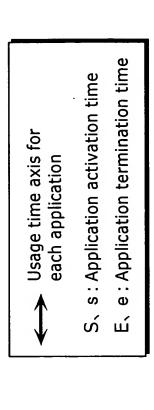
Element ID	Device name	Event details	Event duration
1	Television	Power ON	6:11-6:16
2	Air conditioner	Power ON	6:15-6:20
3	Cooking range	Power ON	7:00-7:05
	Light		
•	•	•	•
•	•	•	•
•	•	•	•
	PC	Power ON	6:45-6:50

FIG. 53



Episode data

Television turning-ON {Air conditioner}



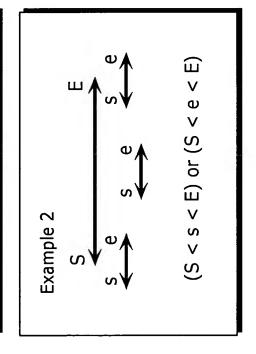


FIG. 56

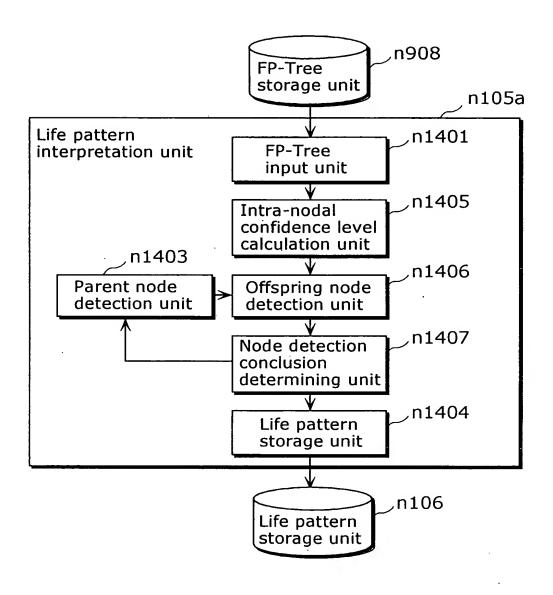
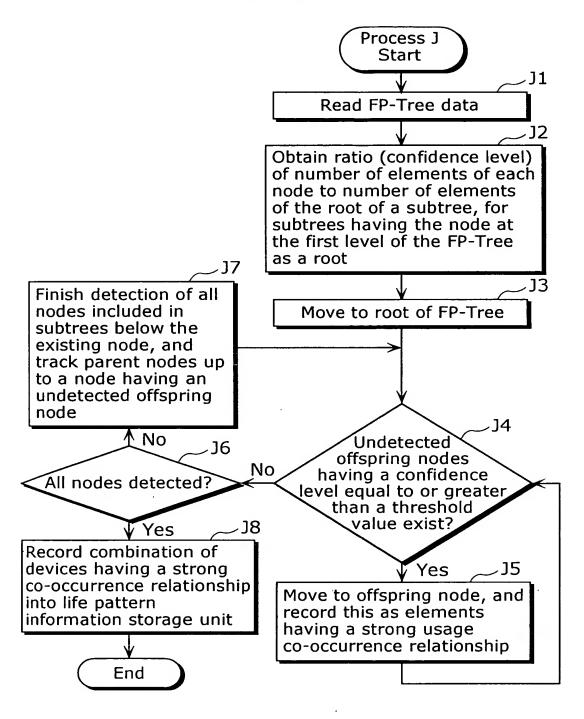
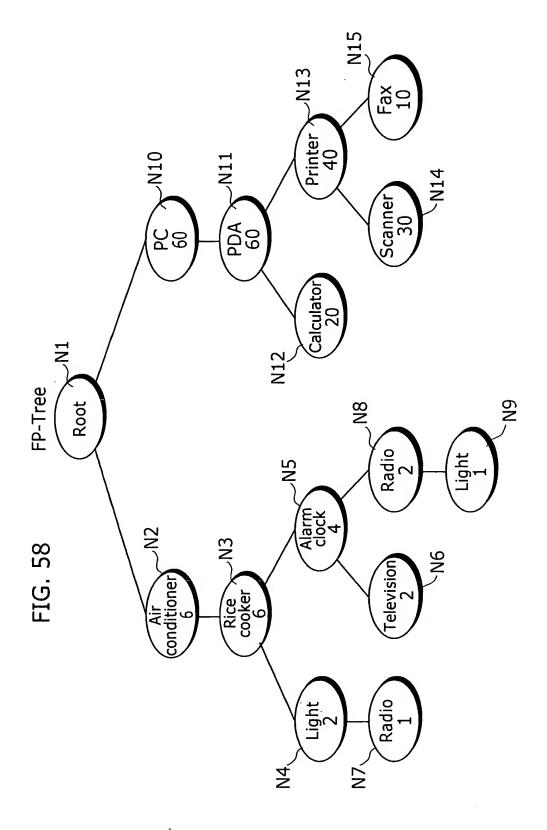
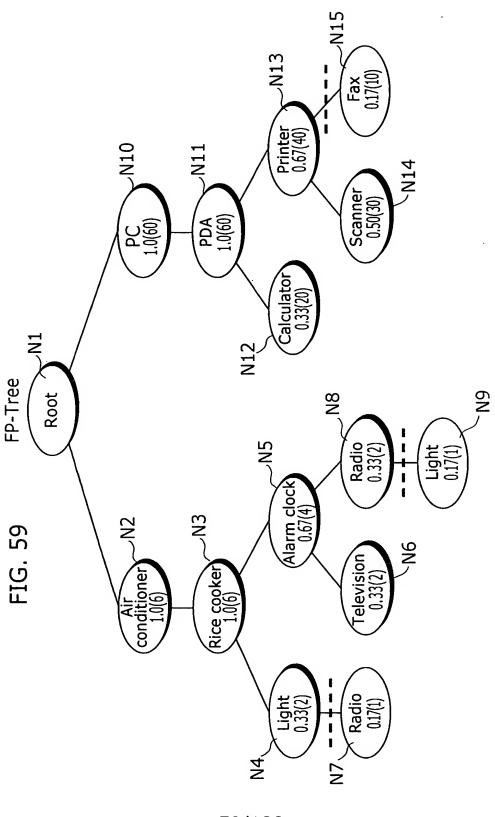


FIG. 57





58/100



59/100

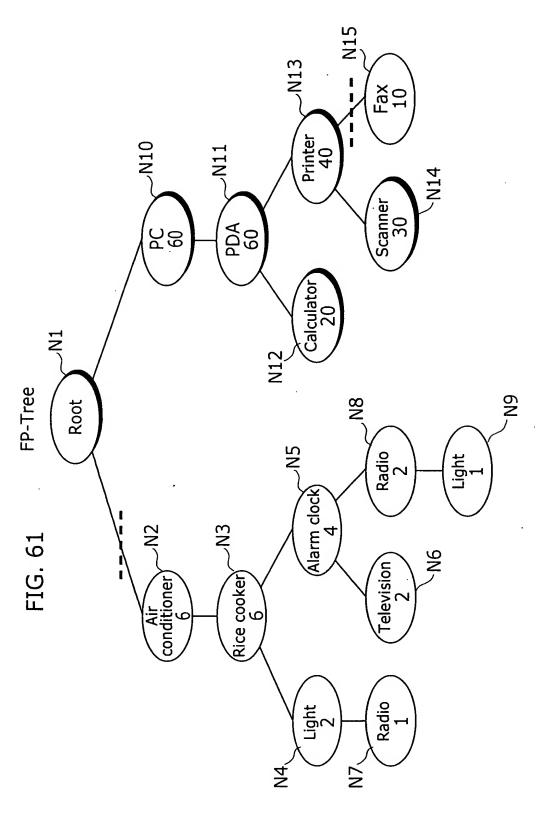
Life pattern information

FIG. 60A

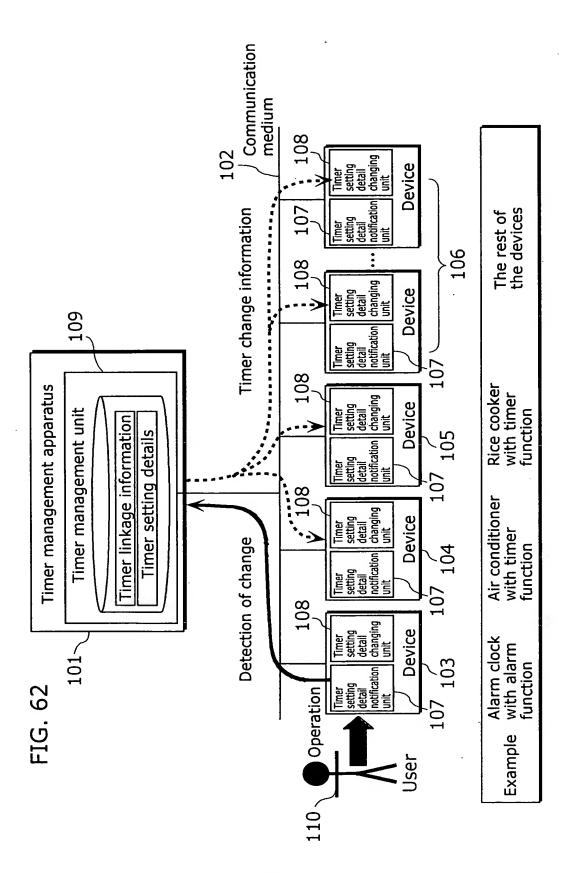
Devices with confidence level equal to or greater than 0.30, with respect to the air conditioner {Rice cooker, light} {Rice cooker, alarm clock, television} {Rice cooker, alarm clock, radio}

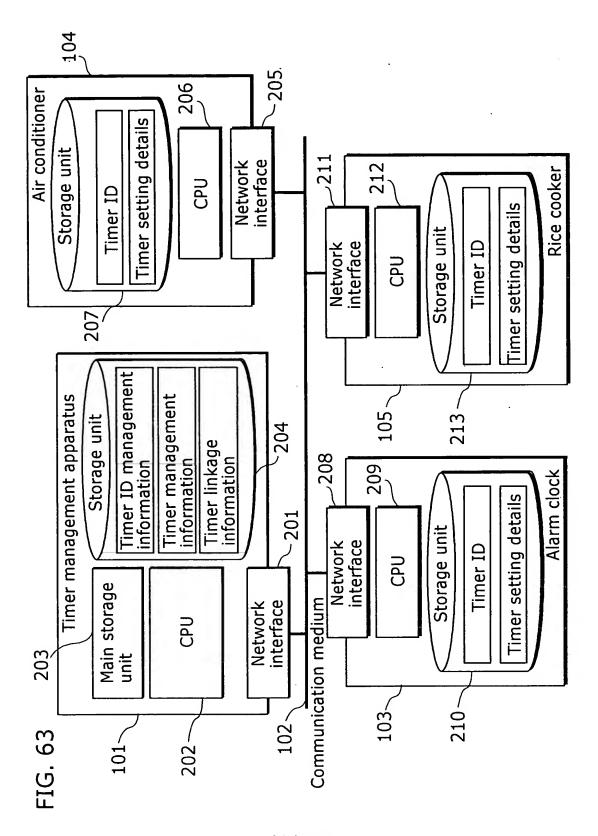
FIG. 60B

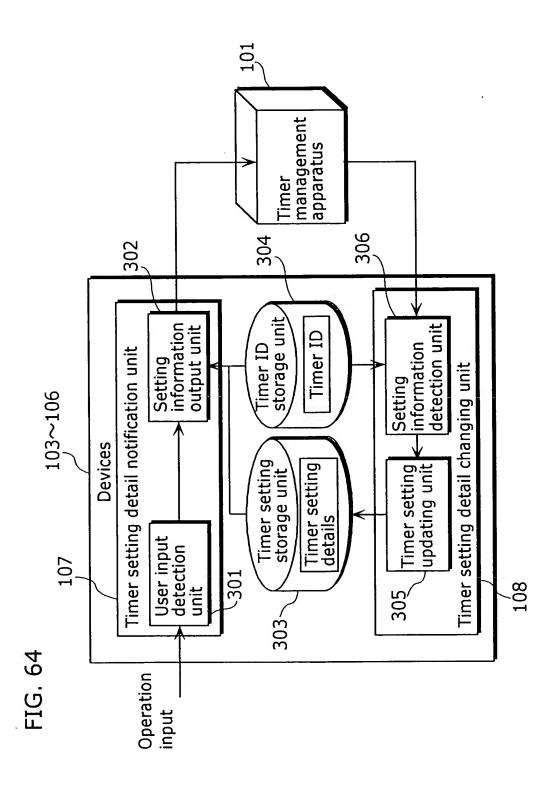
Devices with confidence level equal to or greater than 0.30, with respect to the PC {PDA, calculator} {PDA, printer, scanner}

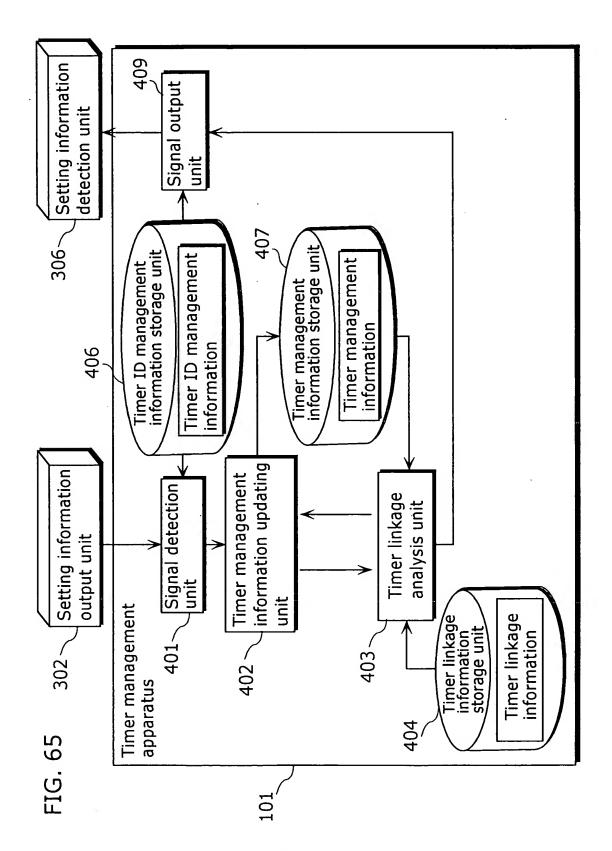


61/100









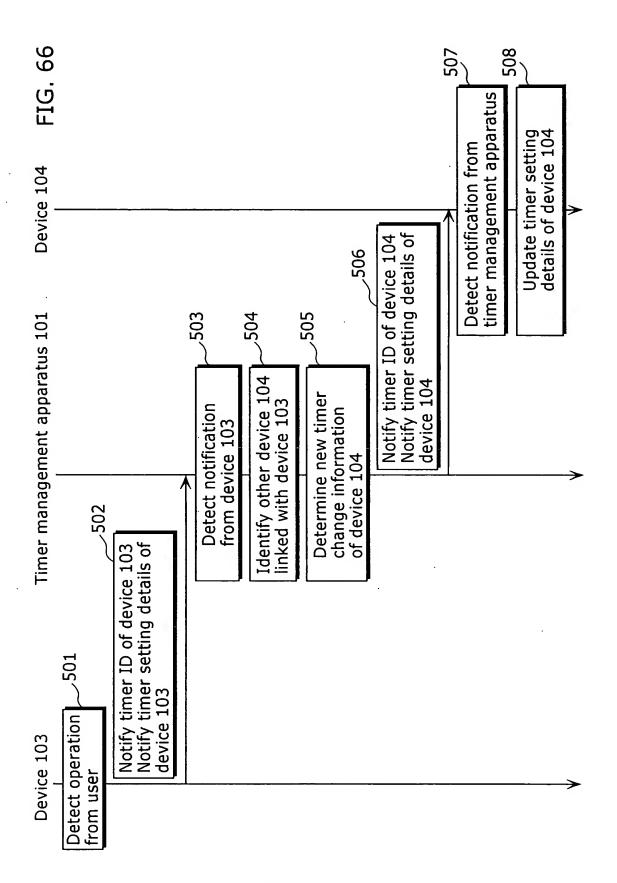


FIG. 67

005 **Television** 004 001 003
Air conditioner Alarm clock Rice cooker 60min 30min 0 -30min 30min 0 -60min -30min Timer linkage information Linked timer ID 001 Air conditioner 002 Alarm clock 003 Rice cooker 004 Television 005 Timer ID Key timer ID

FIG. 68A

Timer management information

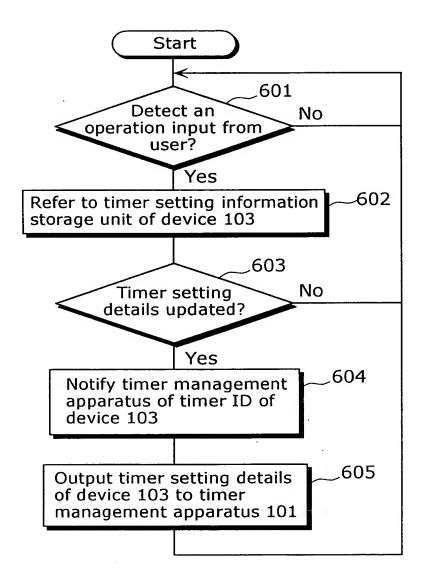
Timer ID	Date	Time	Name	Details of operation
001	02/01/15	06:30:00	Air conditioner	Power ON
002	02/01/15	07:00:00	Alarm clock	Alarm start-up
003	02/01/15	07:30:00	Rice cooker	End cooking
004	02/01/15	07:30:00	Television	Power ON
005				

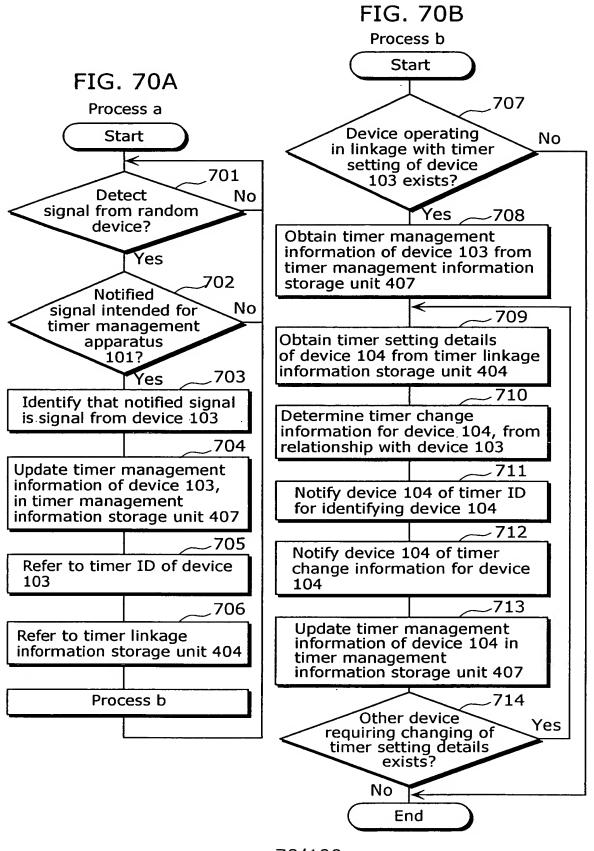
FIG. 68B

Timer management information

Timer ID	Date	Time	Name	Details of operation
001	02/01/15	06:30:00	Air conditioner	Power ON
002	02/01/15	06:00:00	Alarm clock	Alarm start-up
003	02/01/15	07:30:00	Rice cooker	End cooking
004	02/01/15	07:30:00	Television	Power ON
005				

FIG. 69





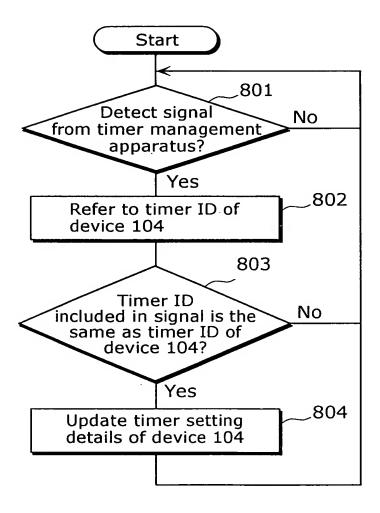
70/100

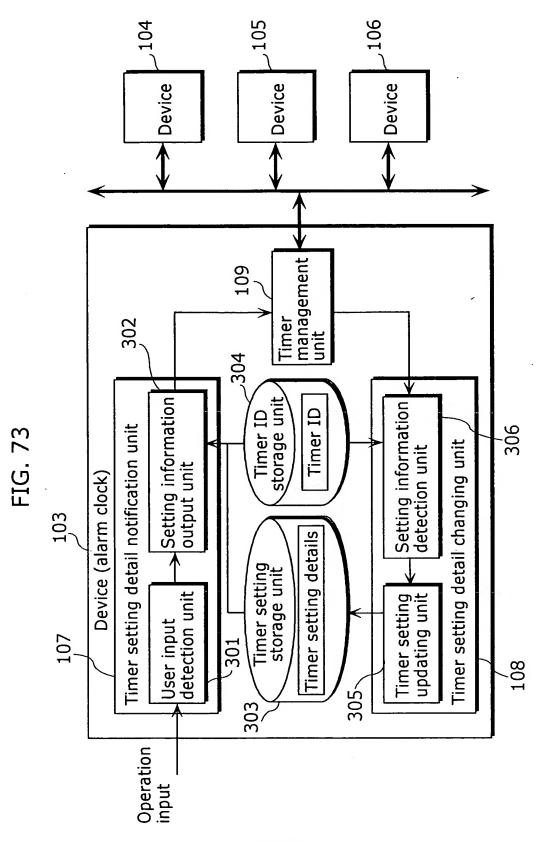
FIG. 71

Timer management information

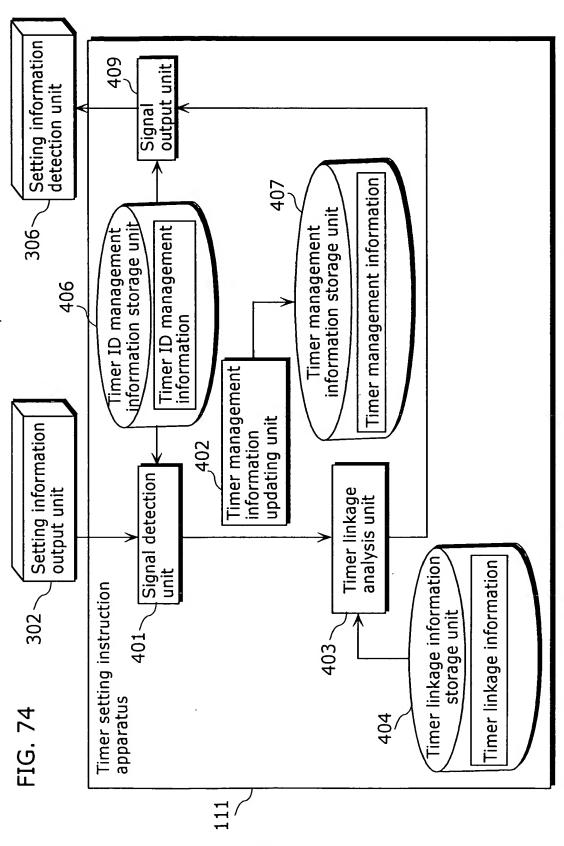
Timer ID	Date	Time	Name	Details of operation
001	02/01/15	05:30:00	Air conditioner	Power ON
002	02/01/15	06:00:00	Alarm clock	Alarm start-up
003	02/01/15	06:30:00	Rice cooker	End cooking
004	02/01/15	07:30:00	Television	Power ON
005				

FIG. 72

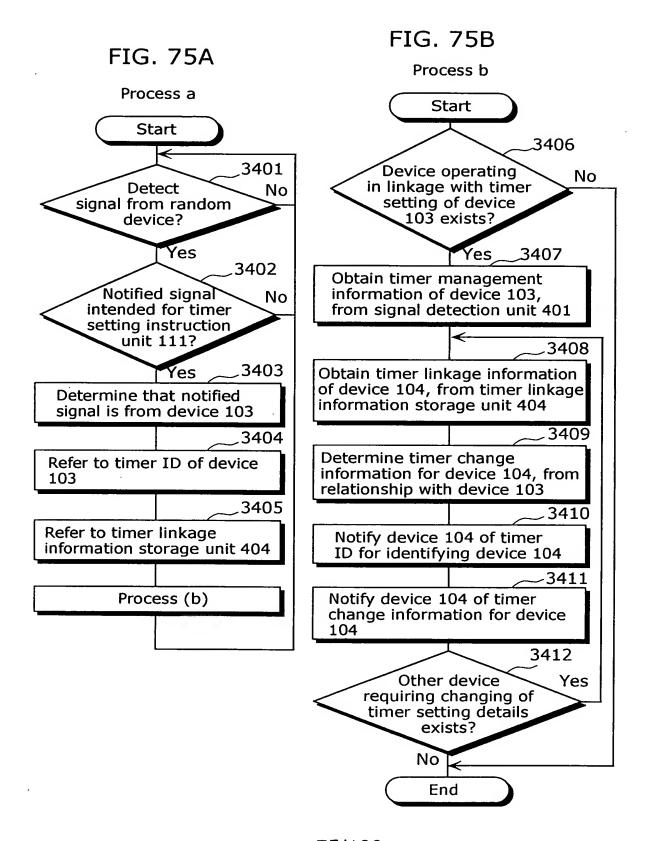




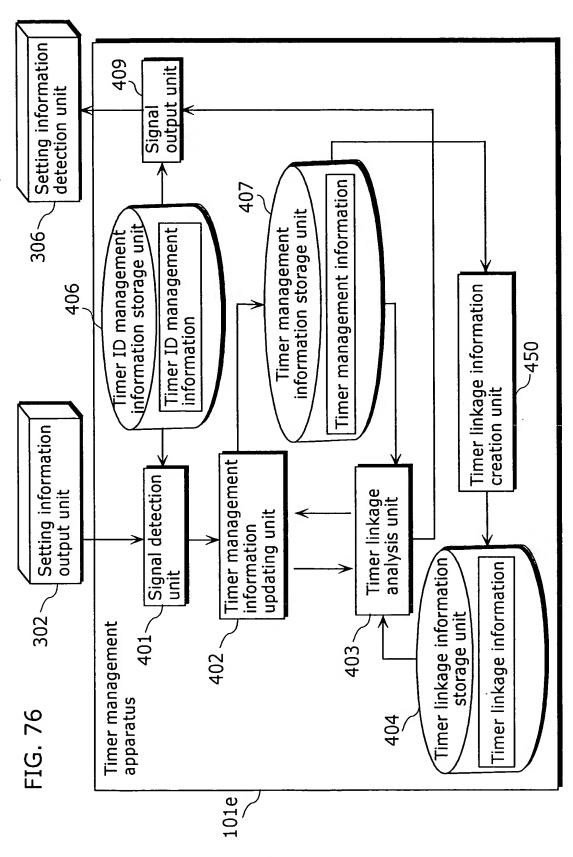
73/100



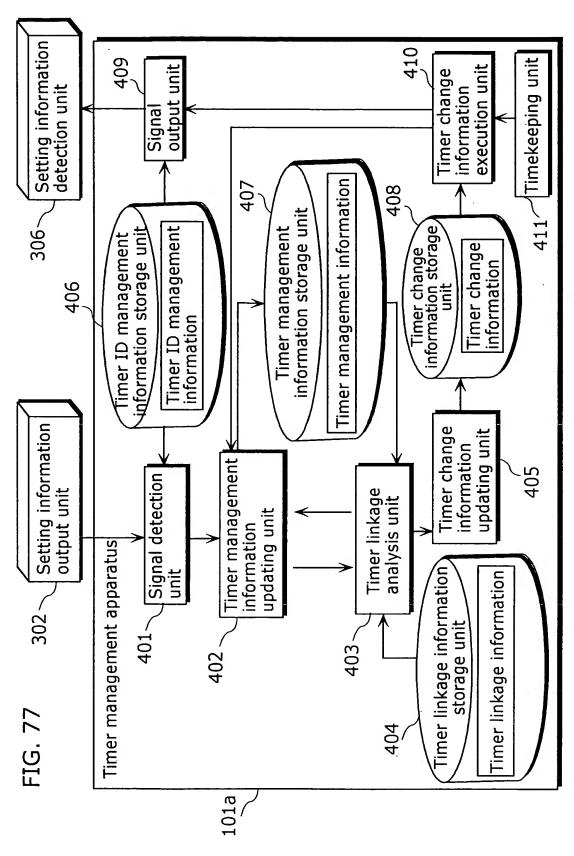
74/100



75/100



76/100



77/100

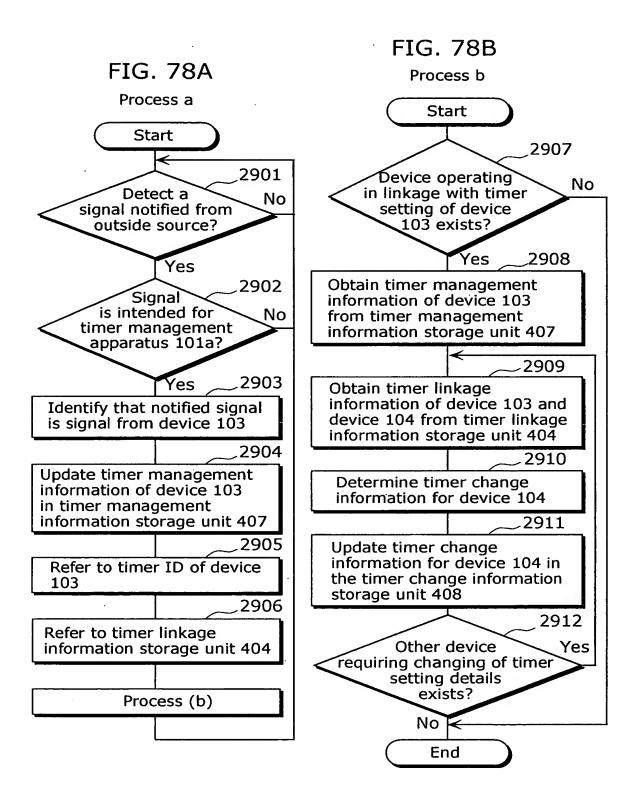


FIG. 79

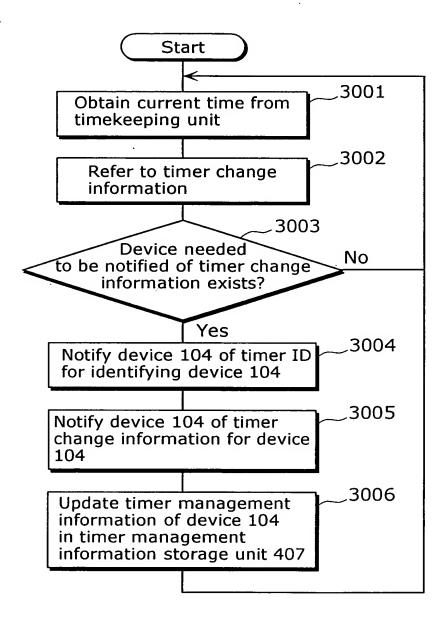


FIG. 80

Timer changing information

05:30:00 06:30:00 Setting time Change device | Details of change Setting of power Setting of end cooking time ON time Immediate | Immediate | Air conditioner Immediate Immediate Rice cooker name Change time execution execution execution Change date execution Change ID 002 003 004 001

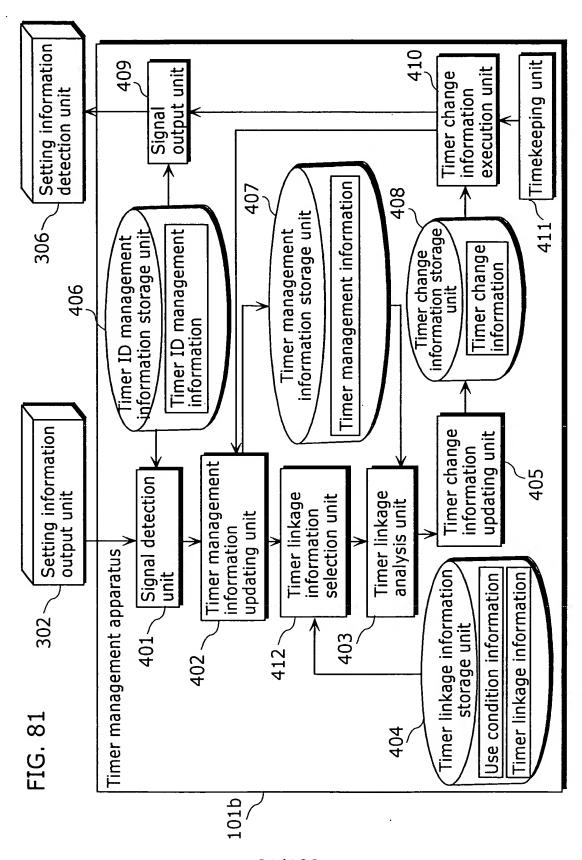


FIG. 82

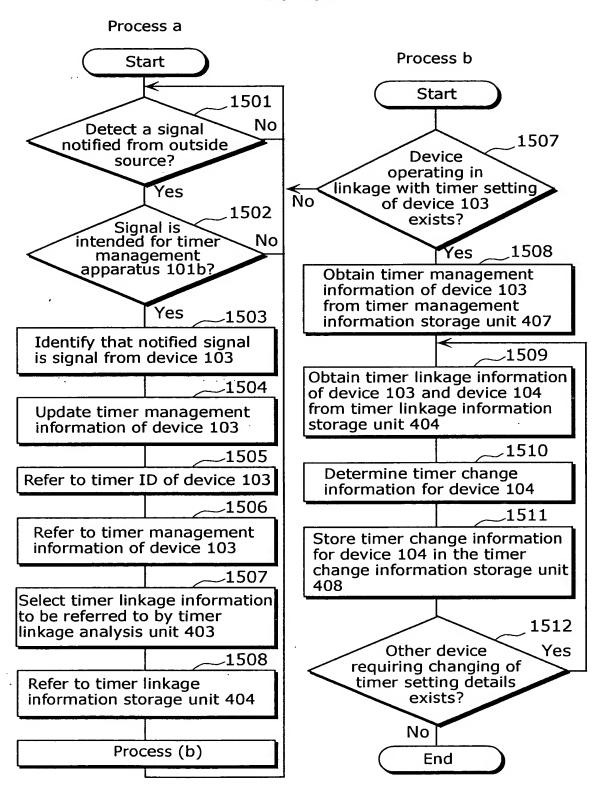
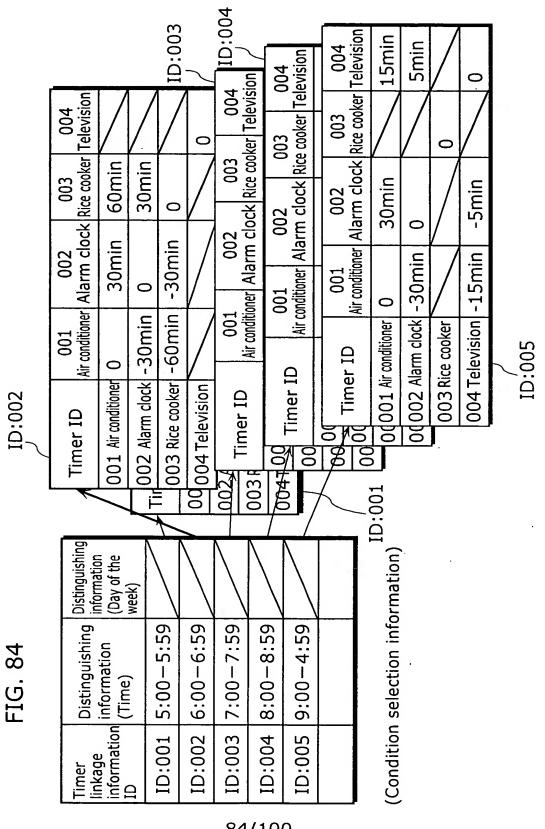


FIG. 83

Condition selection information

Timer linkage information ID	Distinguishing information (Time)	Distinguishing information (Day of the week)
ID:001	5:00-5:59	
ID:002	6:00-6:59	
ID:003	7:00-7:59	
ID:004	8:00-8:59	
ID:005	9:00-9:59	



84/100

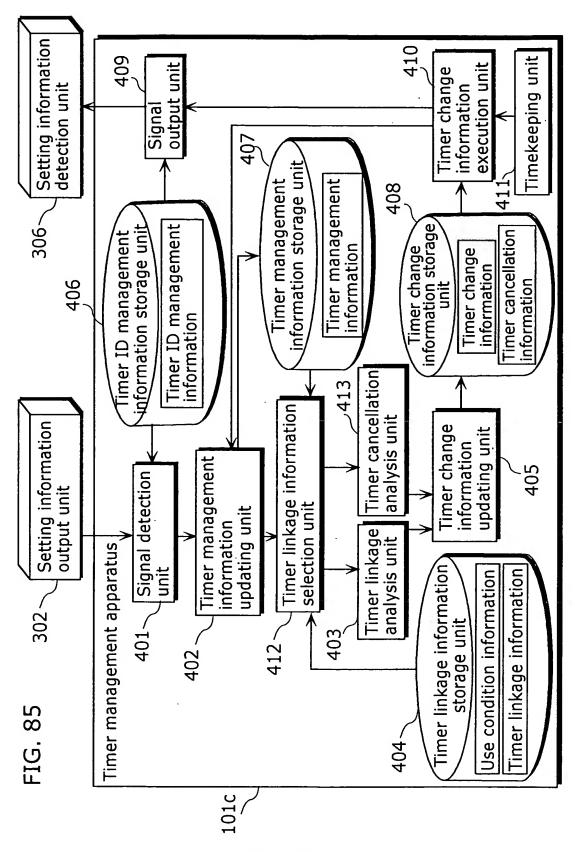
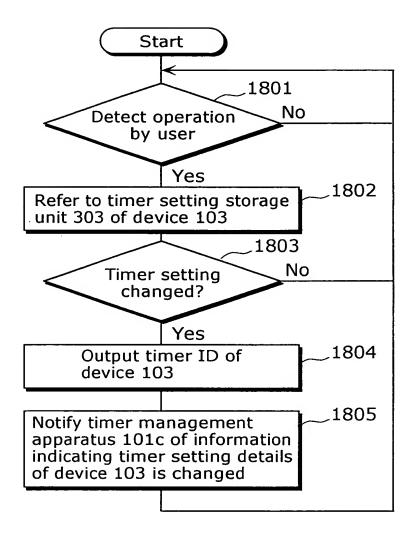


FIG. 86

Cancelled Status Valid Valid Alarm start-up | Valid End cooking Details of operation Power ON Power ON 02/01/15 05:30:00 Air conditioner 02/01/15 06:00:00 Alarm clock 02/01/15|06:30:00|Rice cooker 02/01/15|07:30:00|Television Name Timer management information Time Timer ID Date 002 003 004 005 001

FIG. 87



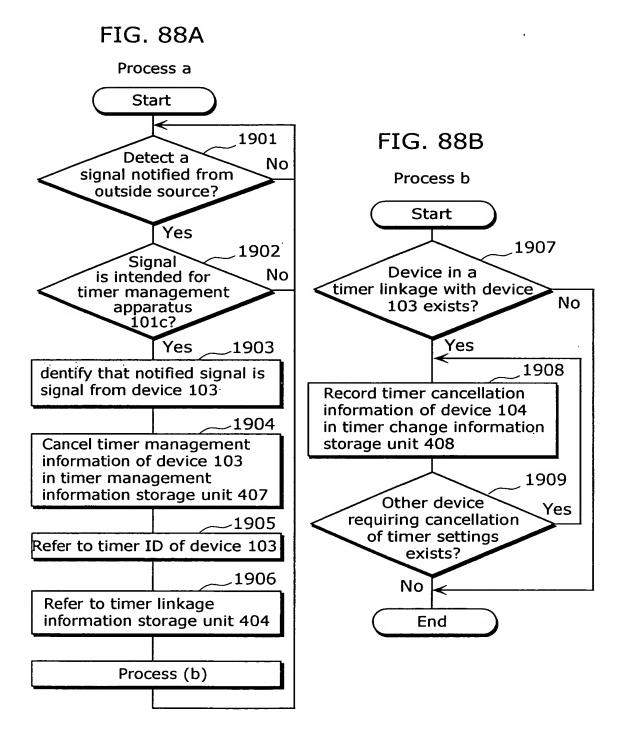


FIG. 89

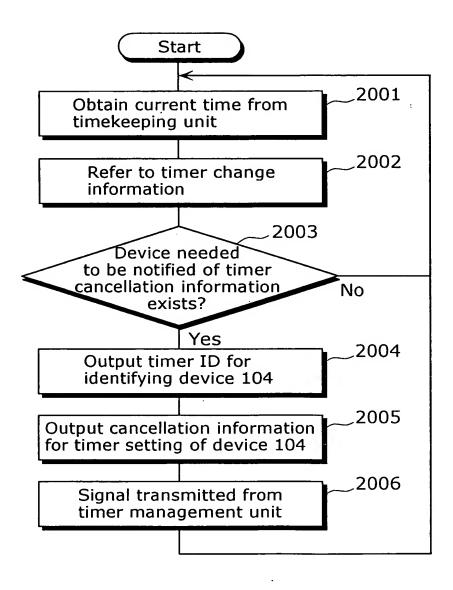
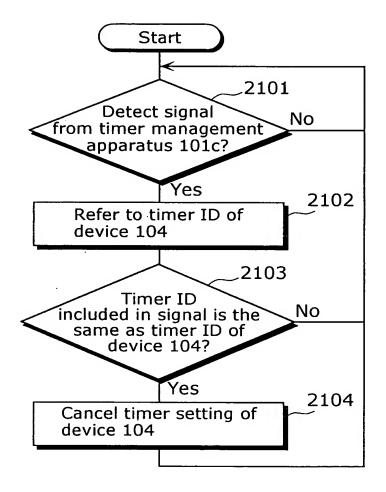


FIG. 90



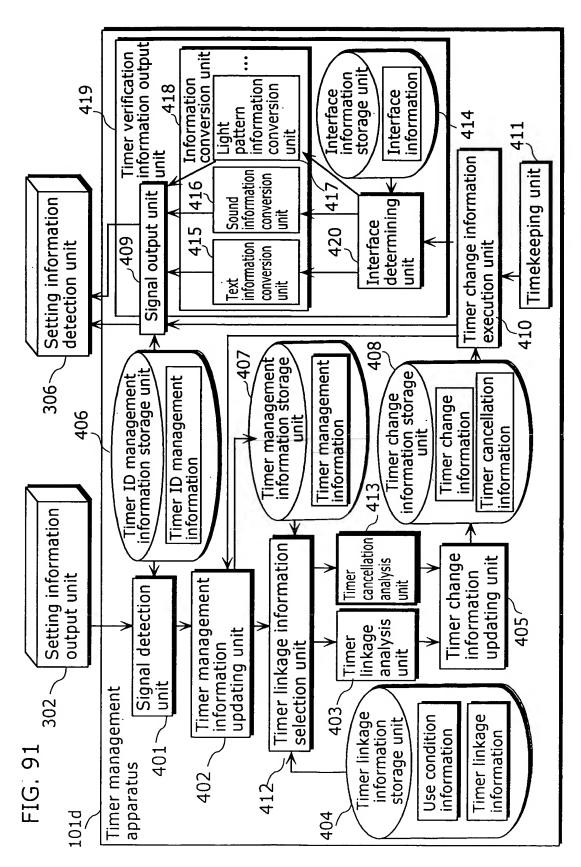
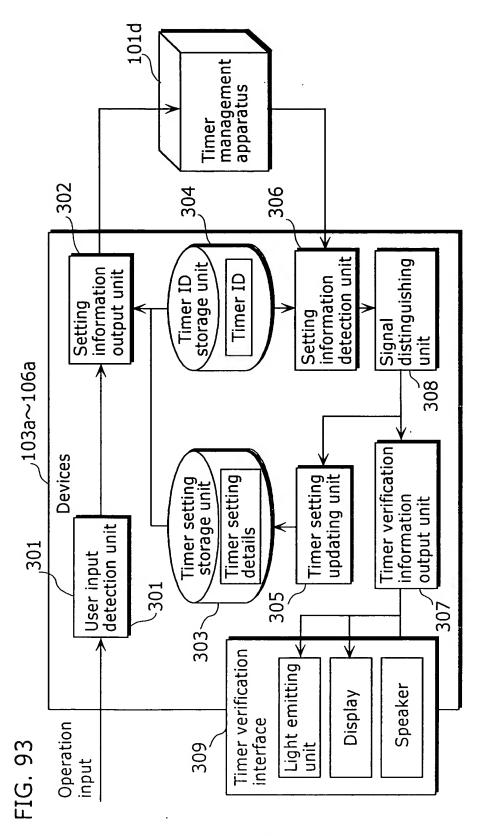


FIG. 92

Interface information

Timer ID	Device name	Interface
001	Air conditioner	Display
002	Alarm clock	Speaker
003	Rice cooker	LED
004	Television	Display, speaker



93/100

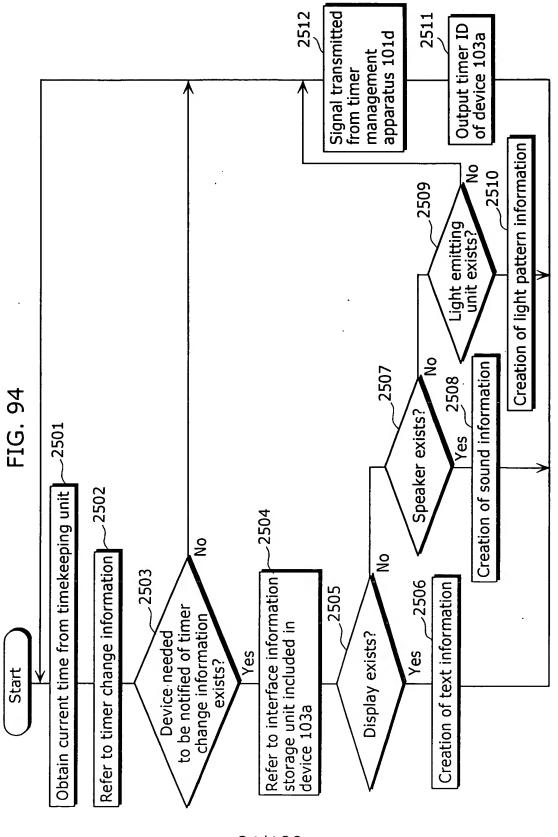


FIG. 95

